

Mill Creek – Fish Passage at Gose Street

**Project Goal: Develop a Conceptual Plan for fish passage
which includes flood protection and secure infrastructure –
for the long-term and low maintenance**



2/17/23



Current Condition as of Yesterday

Agenda

Geomorphic Assessment

Fishway Concepts/Photos

Conceptual Design Options (6)

Gravel Augmentation

Channel Sections

Hydraulic Modeling

Other Fish Passage Issues

Alternatives Analysis Matrix

Discussion

**40 min
Presentation**

Break....?

**50 min
Discussion**

2/17/23



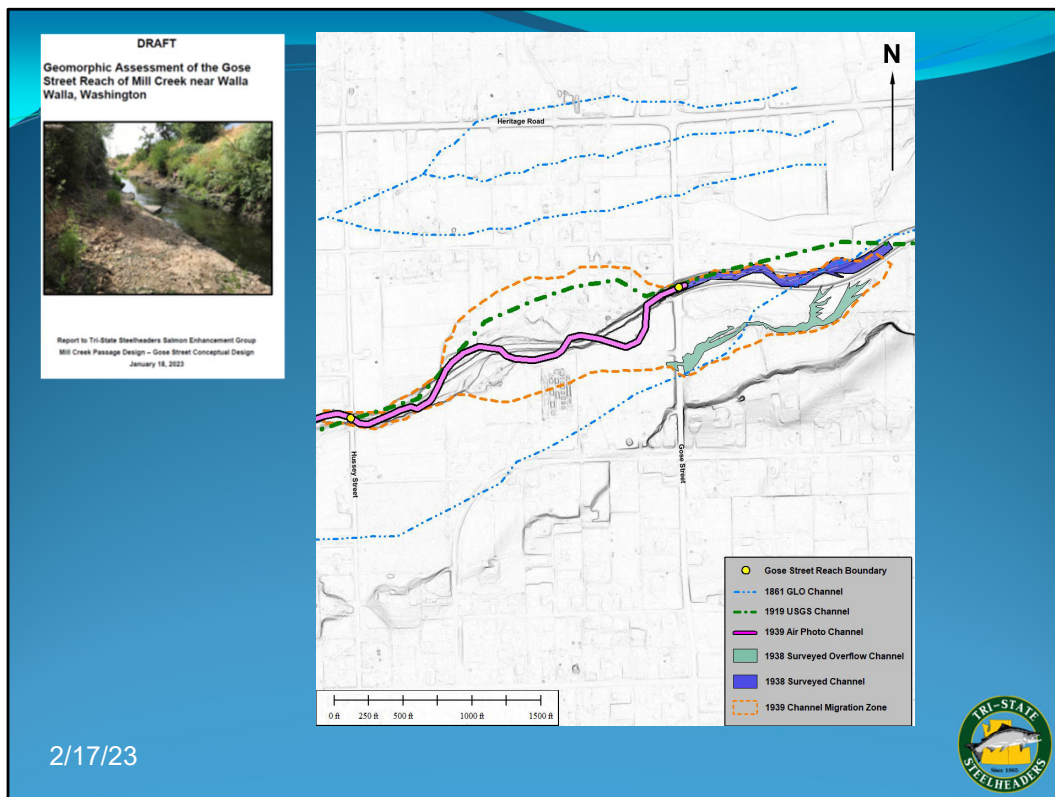


Figure 8 Mill Creek Channel Locations Prior to Flood Control Channel

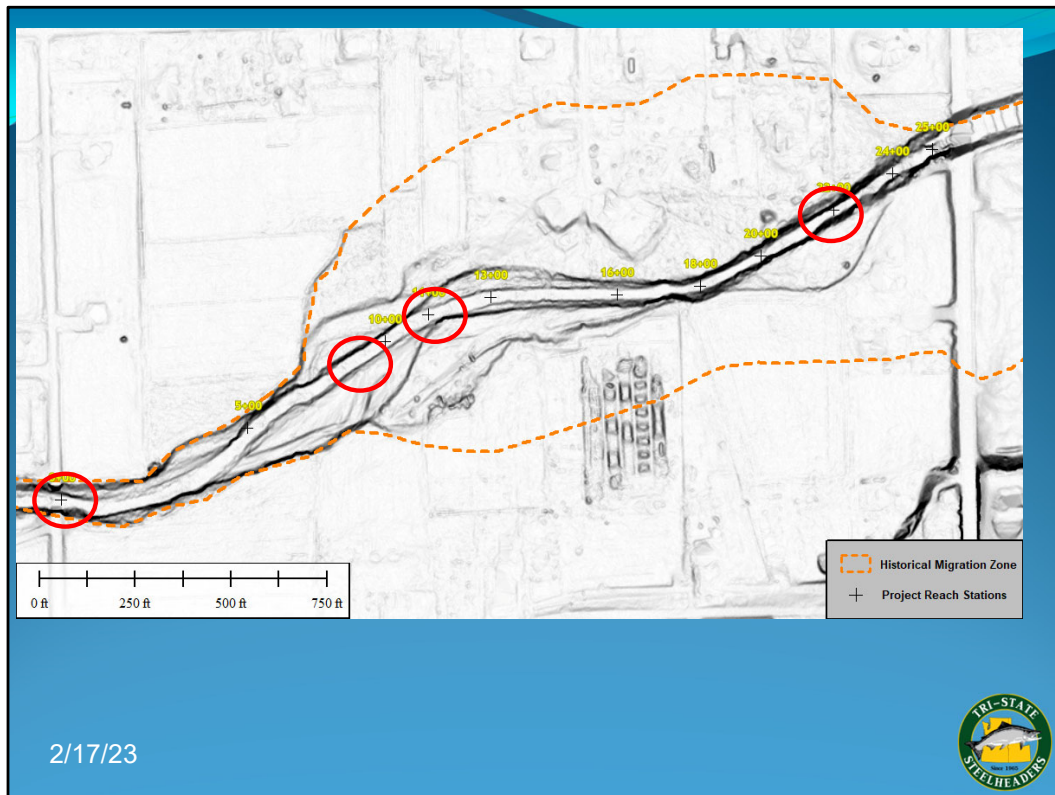
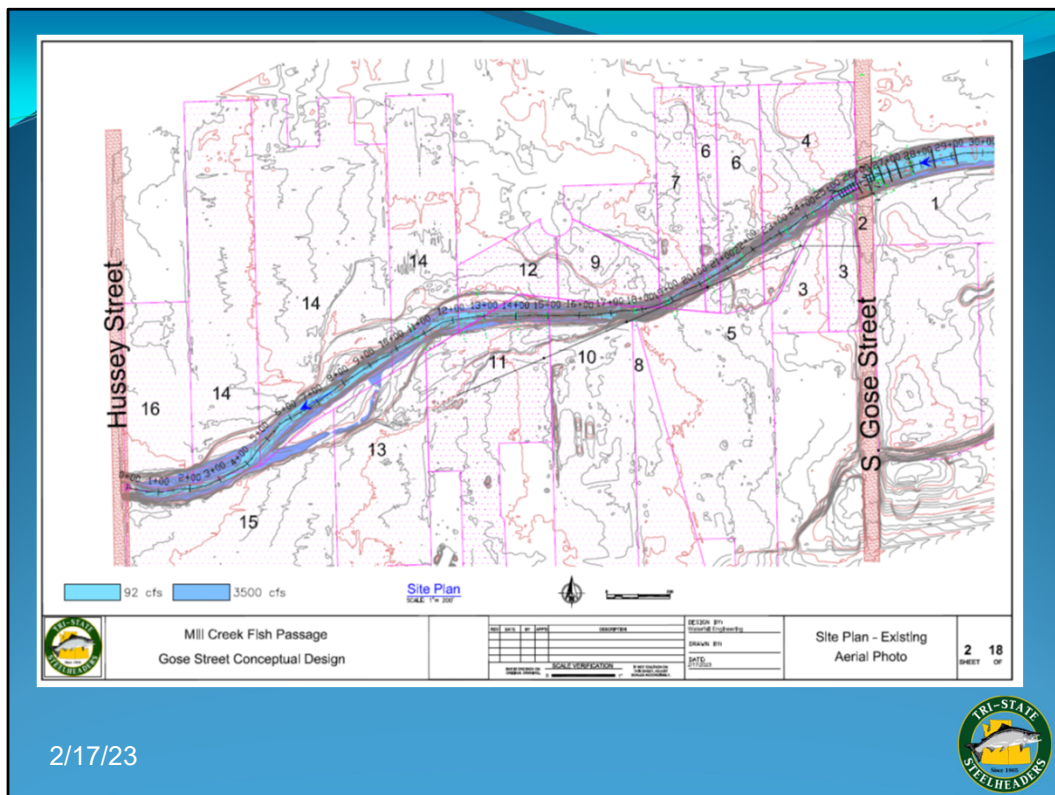
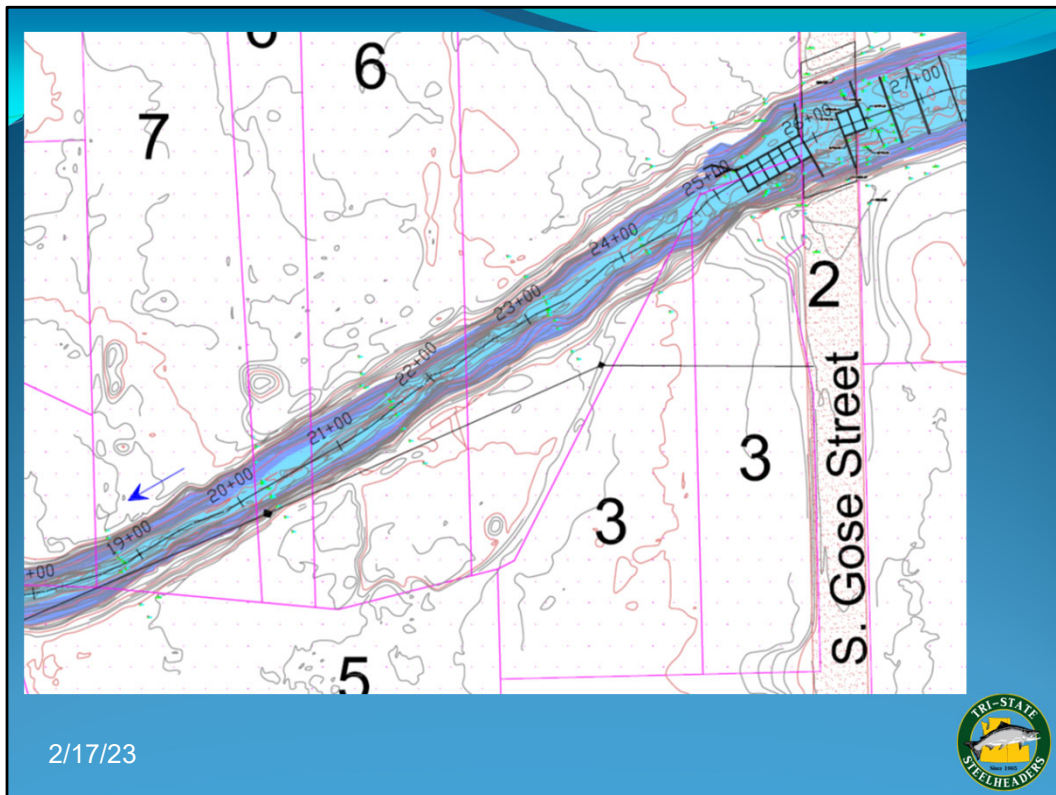


Figure 14 LiDAR bare-earth shaded relief and Project Stationing. Red Circles Area of Incision Assessment.



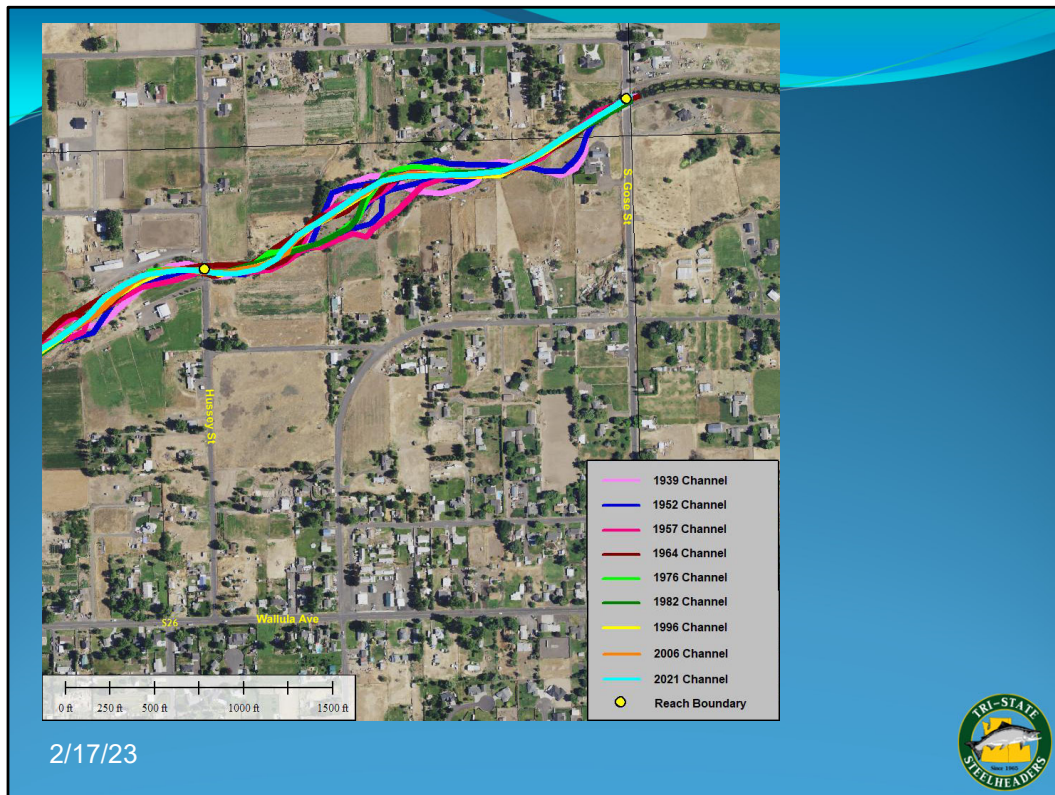
Channel Stationing Gose to Hussey. Gose at 26+00, Hussey at 0+00



Channel Stationing Below S. Gose Street



Figure 7 showing 1939 Channel Migration Zone prior to construction of the flood control project.



Channel locations from 1939 to 2021

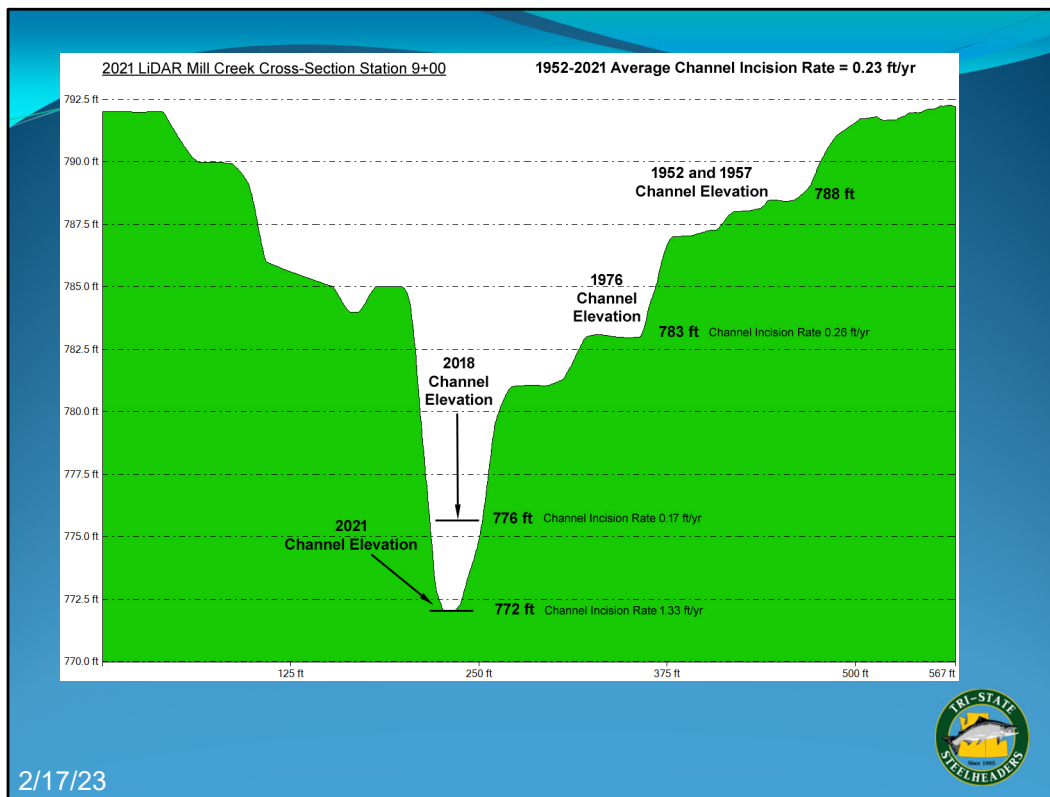


Figure 21 Historical Channel Elevations and Incision Rates, STA 9+00

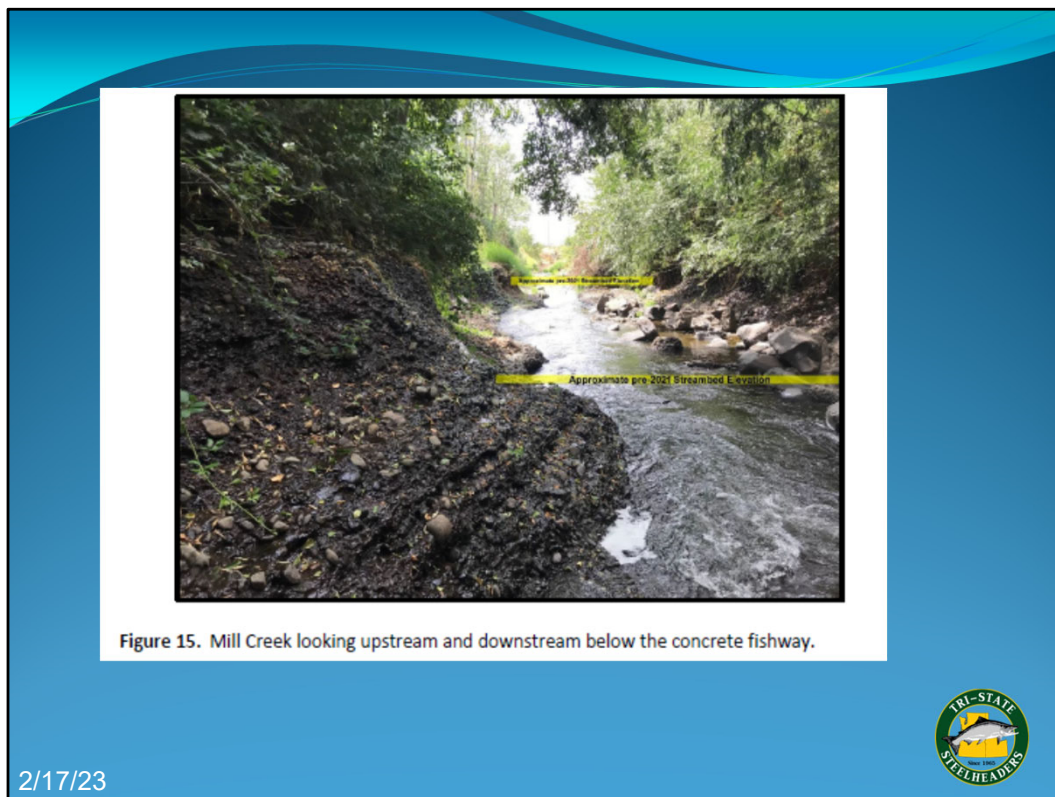
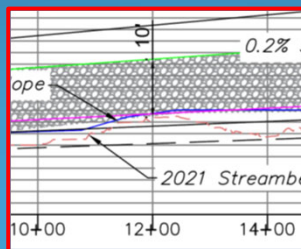
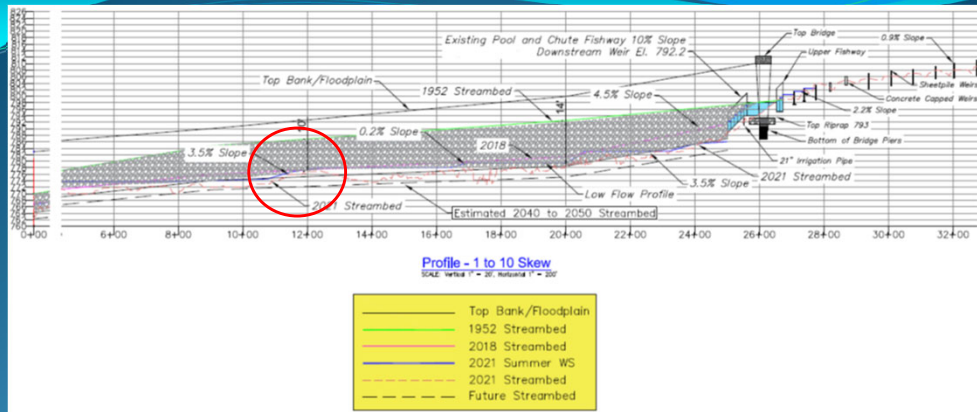


Figure 15 Channel Lowering Below Fishway from 2018 to 2021



2/17/23

STA 12+00 Photo



2/17/23



Photo Upstream at STA 12+00

Ave. Channel Incision 0.2 ft/yr

Location	Methodology	Data Range	Incision Depth (ft)	Time Frame (yr)	Incision Rate (ft/yr)
Station 22+00	Aerial photographs and LIDAR DEMs	1952-2021	20	69	0.29
Station 9+00	Aerial photographs and LIDAR DEMs	1952-1976	5	24	0.26
Station 9+00	Aerial photographs and LIDAR DEMs	1976-2018	7	42	0.17
Station 9+00	Aerial photographs and LIDAR DEMs	2018-2021	4	3	1.33
Station 9+00:	Aerial photographs and LIDAR DEMs	1952-2021	16	69	0.23
Hussey Street Bridge	Surveyed Cross-Sections	1976-2020	8	44	0.18
Station 11+00 Station 22+00	Surveyed Cross-Sections and LIDAR DEMs	1983-2021	6	38	0.16

Table 2. Summary of channel incision rates estimated for the Mill Creek project reach.

1931 - ??

1946 – 2760 cfs (15 years)

1996 – 4200 cfs (50 years)

2020 – 4700 cfs (24 years)



2/17/23

Table 2 from Report

Example Photos



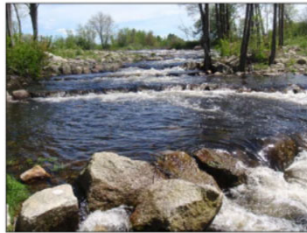
2/17/23

Ray Troll T Shirt

Nature Like Fishways



Saw Mill Park step-pool fishway,
Acushnet River, Acushnet, MA



Fields Pond step-pool fishway,
Sedgeunkedunk Stream, Orrington, ME



Kenyon Mill step-pool fishway,
Pawcatuck River, Richmond, RI



Homestead dam removal and NLF cross-vanes,
Ashuelot River, West Swanzey, NH

2/17/23



NOAA/USGS/FWS 2016 Publication of Nature Like Fishways

Nature Like Fishways



2/17/23

Nature-like Fishway Examples Types – Roughened Channels and Constructed Riffles

Nature Like Fishways



2/17/23



Nelson Dam Example – Reference Reach Due to Unit Discharge – 2% Slope

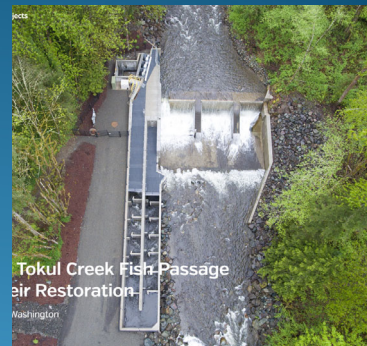
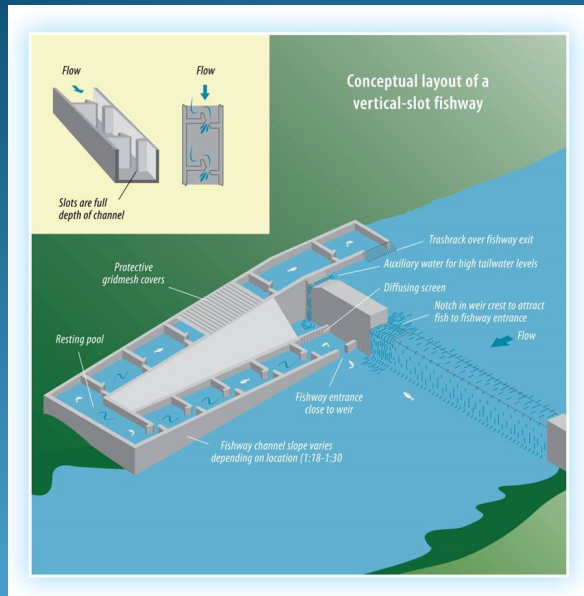
Pool and Chute Fishways



2/17/23

Examples of Pool and Chute Fishways

Pool and Weir Fishways



2/17/23

Examples of Pool and Weir Fishways

Pool and Weir Fishways

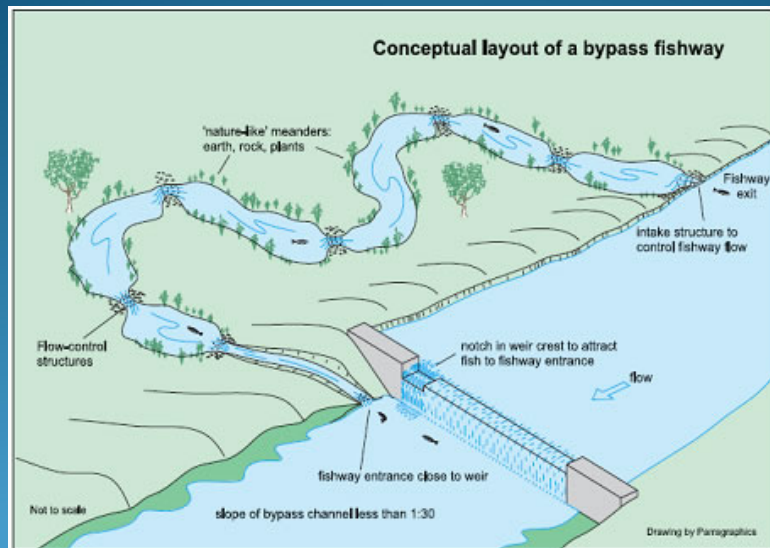


2/17/23



Examples of Pool and Weir Fishways

Bypass Channels



2/17/23

Examples of Bypass Channel

Bypass Channels

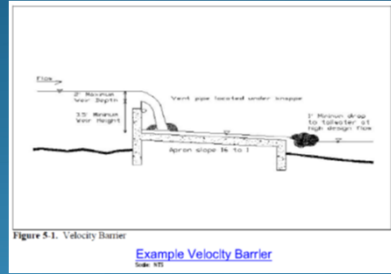


2/17/23



Examples of Bypass Channel

Barrier Dams



2/17/23

Examples of Barrier Dams, N Fk Toutle River Fish Collection Facility

Channel Weirs



2/17/23

Examples Channel Weirs – Goldsborough Creek Dam Removal

Channel Weirs



2/17/23



Examples Channel Weirs – Goldsborough Creek Dam Removal – Note Willows along edge

Channel Weirs



2/17/23

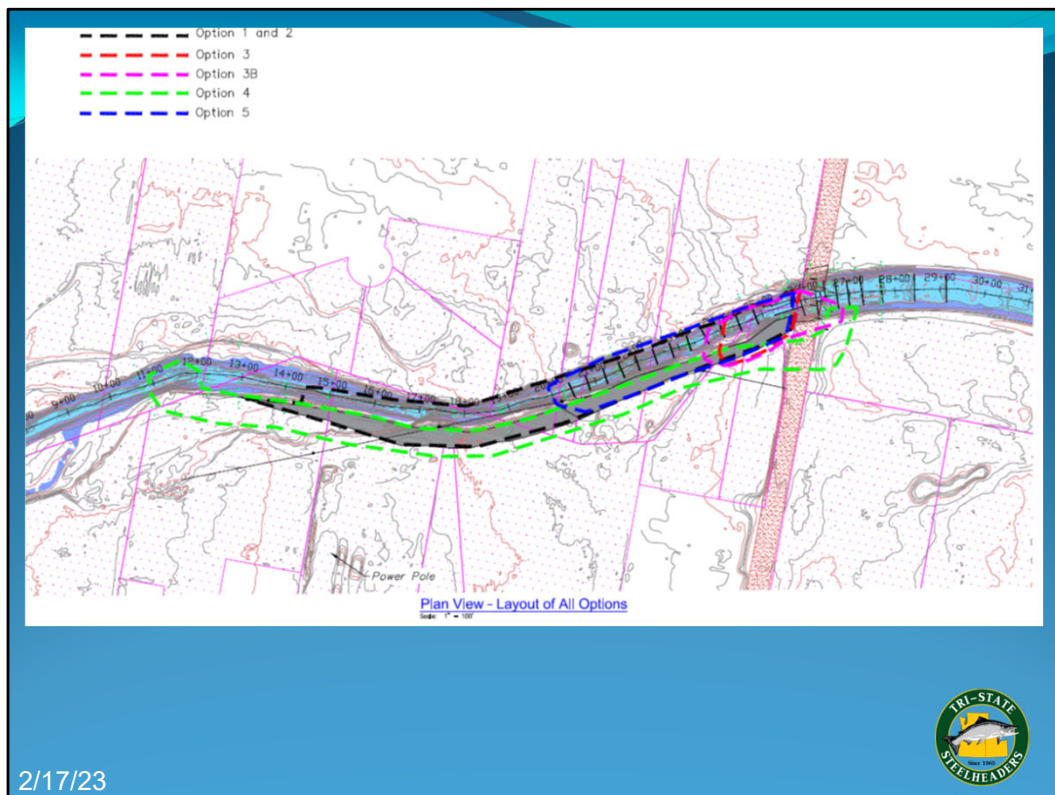


Examples Channel Weirs – Mill Creek

		Option 1	Option 2	Option 3	Option 3B	Option 4	Option 5	Option 5B	Gravel Augmentation
		Nature-like Fishway (800' Long) with Pool and Chute Fishway	Nature-like Fishway (1100' Long)	12 Step Pool and Weir Fishway w/Dam to Backwater Existing Fishway	23 Step Pool and Weir Fishway w/Dam and Abandon Existing Fishways	Bypass Channel 1670' Long with Barrier Dam and Flow Control	12 Concrete or Sheeppile Weirs to Backwater Existing Fishway	27 Concrete or Sheeppile Weirs to Backwater Existing Fishway up to Flood Control Channel	Five Rock Sills with Roughened Channel and Gravel Storage Piles Behind Structures to Raise Bed and Floodplain
Map Number	Land Owner								
1	Arevalo								
2	County								
3	Keeler								
4	Fausti								
5	Villegas								
6	Lopez								
7	Alden								
8	Ruzicka								
9	Laufer								
10	Robertson								
11	Edwards								
12	Moore								
13	Meza								
14	Castoldi								
15	Norton								
16	Eggleston								
Design Variables		Yes	Yes	Yes	No	No	Yes	No	
Modify Existing Fishway		Yes	Yes	No	No	No	Yes	Yes	
Channel Widening		Yes	No	Yes	Yes	Yes	Yes	Yes	
New Concrete Structures		Yes	Yes	No	No	Yes	No	No	
Nature-like Fishway		Yes	Yes	No	No	No	No	No	
Gravel Augmentation		Yes	Yes	No	No	No	No	No	

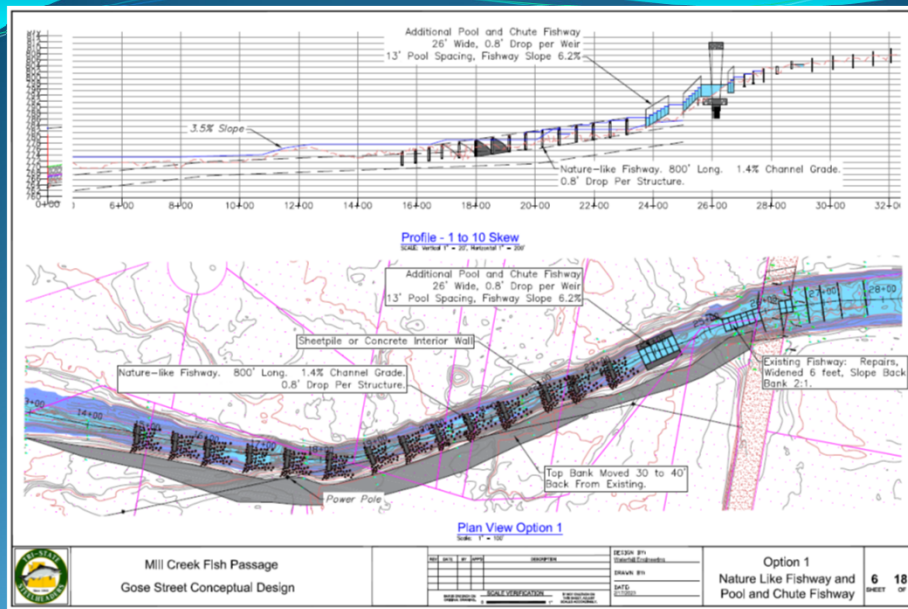
2/17/23

Design Variables/Affected Landowners



Layout All Options

Option 1

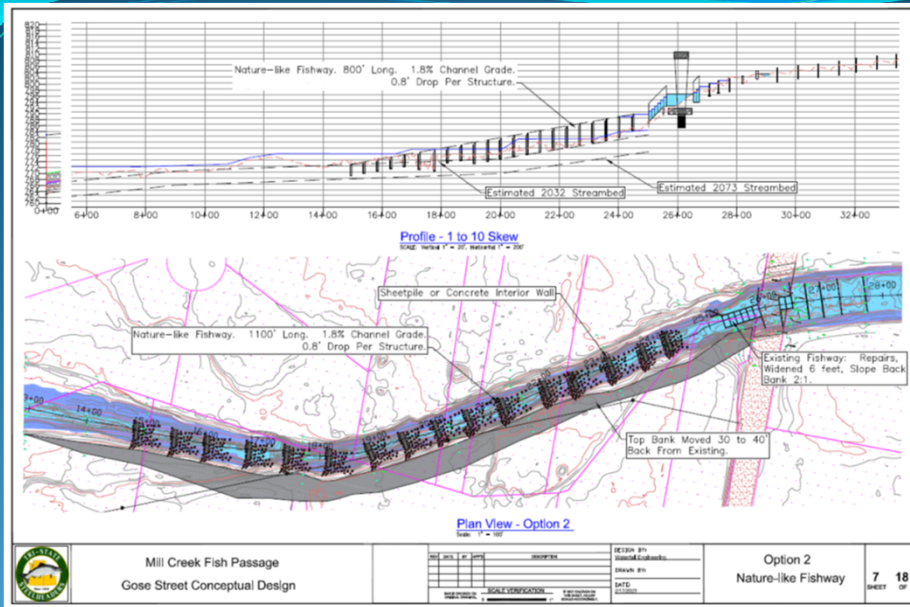


2/17/23



Option 1

Option 2

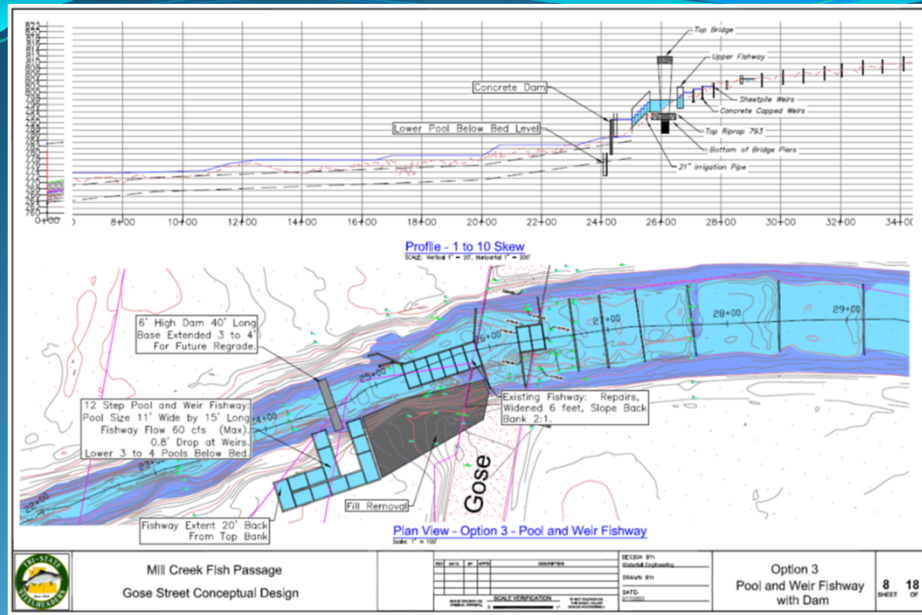


2/17/23



Option 2

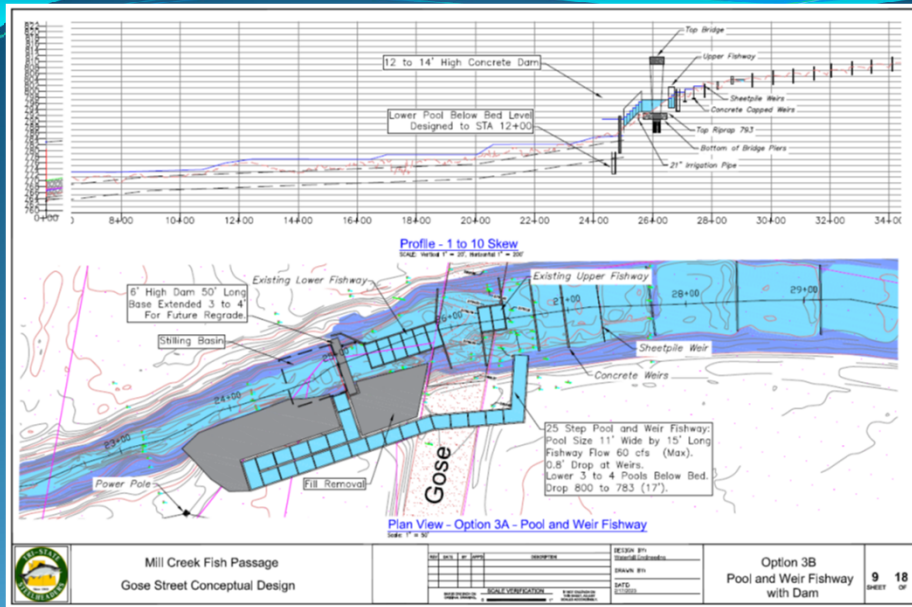
Option 3



2/17/23

Option 3

Option 3B

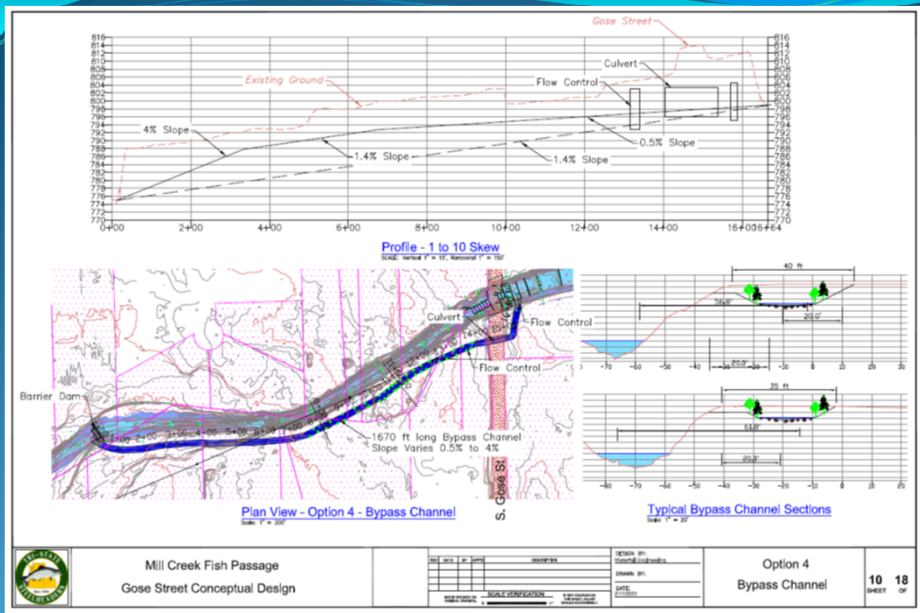


2/17/23



Option 3B

Option 4

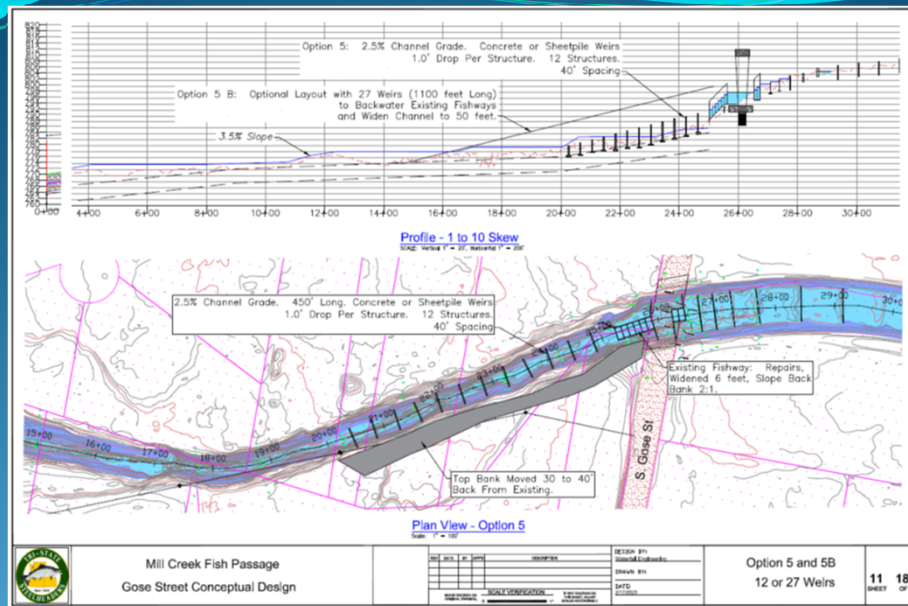


2/17/23



Option 4

Option 5 and 5B



2/17/23



Option 5 and 5B

Gravel Augmentation

The map shows a plan view of a river channel with various structures and elevations. Key features include:

- Rock Sills/Roughened Channel:** 20' Long, 4% Slope, 0.8' Drop.
- Gravel Augmentation/Piles:** Multiple locations along the channel.
- Elevations:** 12.500, 12.400, 12.300, 12.200, 12.100, 12.000, 11.900, 11.800, 11.700, 11.600, 11.500, 11.400, 11.300, 11.200, 11.100, 11.000, 10.900, 10.800, 10.700, 10.600, 10.500, 10.400, 10.300, 10.200, 10.100, 10.000, 9.900, 9.800, 9.700, 9.600, 9.500, 9.400, 9.300, 9.200, 9.100, 9.000, 8.900, 8.800, 8.700, 8.600, 8.500, 8.400, 8.300, 8.200, 8.100, 8.000, 7.900, 7.800, 7.700, 7.600, 7.500, 7.400, 7.300, 7.200, 7.100, 7.000, 6.900, 6.800, 6.700, 6.600, 6.500, 6.400, 6.300, 6.200, 6.100, 6.000, 5.900, 5.800, 5.700, 5.600, 5.500, 5.400, 5.300, 5.200, 5.100, 5.000, 4.900, 4.800, 4.700, 4.600, 4.500, 4.400, 4.300, 4.200, 4.100, 4.000, 3.900, 3.800, 3.700, 3.600, 3.500, 3.400, 3.300, 3.200, 3.100, 3.000, 2.900, 2.800, 2.700, 2.600, 2.500, 2.400, 2.300, 2.200, 2.100, 2.000, 1.900, 1.800, 1.700, 1.600, 1.500, 1.400, 1.300, 1.200, 1.100, 1.000, 0.900, 0.800, 0.700, 0.600, 0.500, 0.400, 0.300, 0.200, 0.100, 0.000.

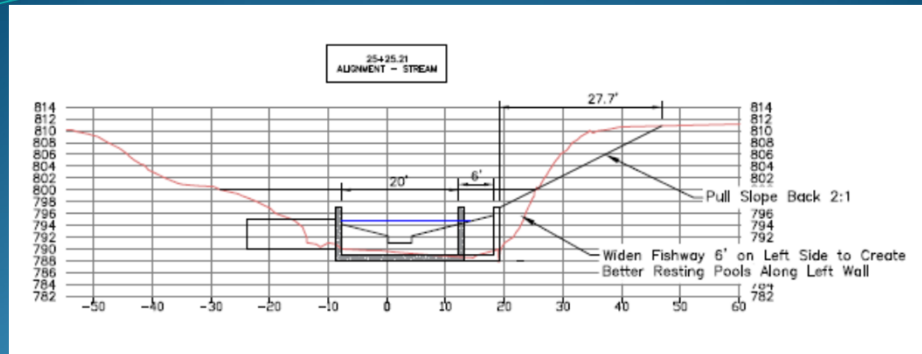
Plan View - Gravel Augmentation

	Mill Creek Fish Passage Gose Street Conceptual Design	DATE: 11/11/11 SCALE: 1" = 100' DRAWN BY: [blank] CHECKED BY: [blank] DESIGNED BY: [blank]	DESIGN BY: [blank]	Gravel Augmentation Option 1 and 2, 5	12 18 SHEET OF
			DRAWN BY: [blank]		

2/17/23

35

Channel Sections

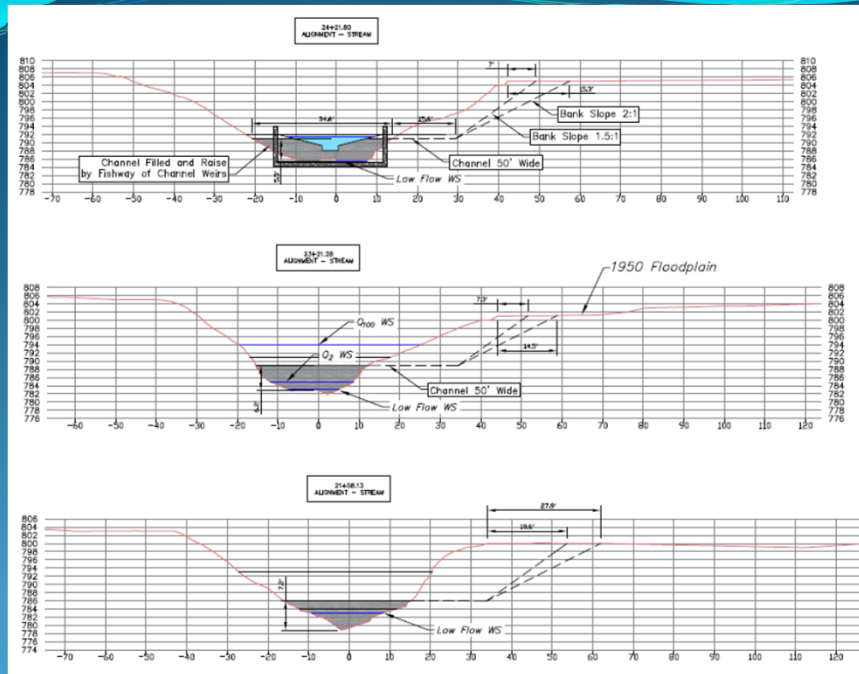


2/17/23



Channel Section at Existing Pool and Chute Fishway

Channel Sections

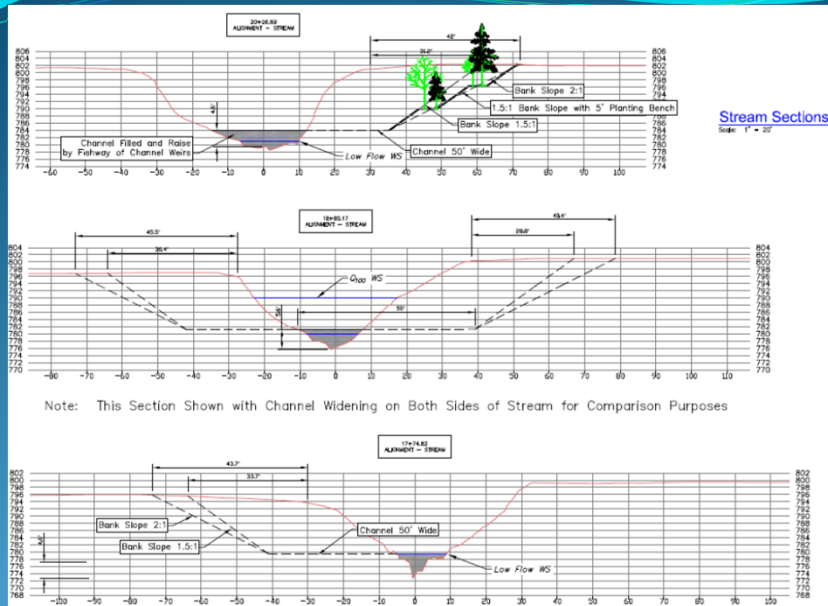


2/17/23



Channel Sections 21+00 to 24+00

Channel Sections



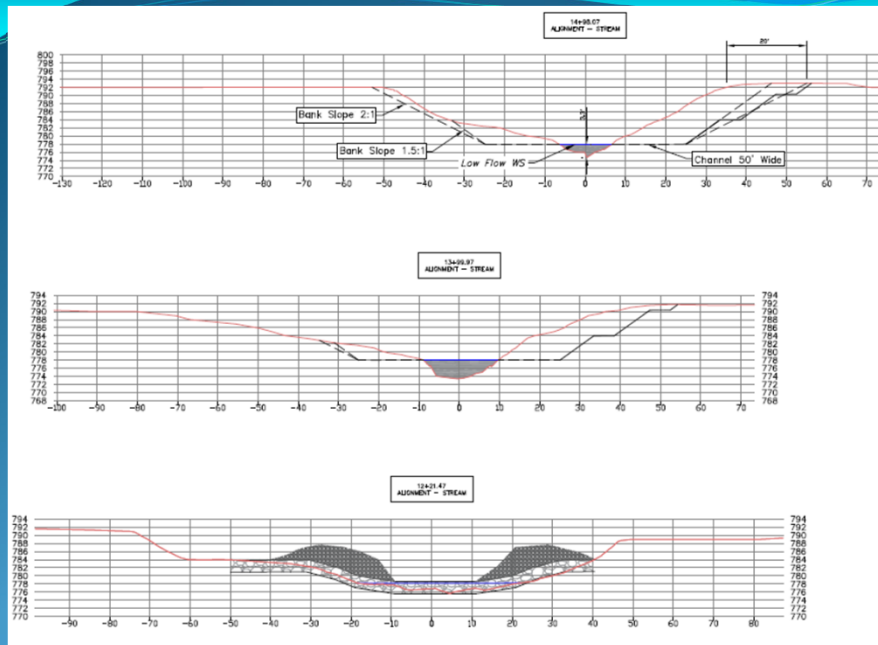
Stream Sections -
Scale 1" = 20'

2/17/23



Channel Sections 18+00 to 20+00

Channel Sections

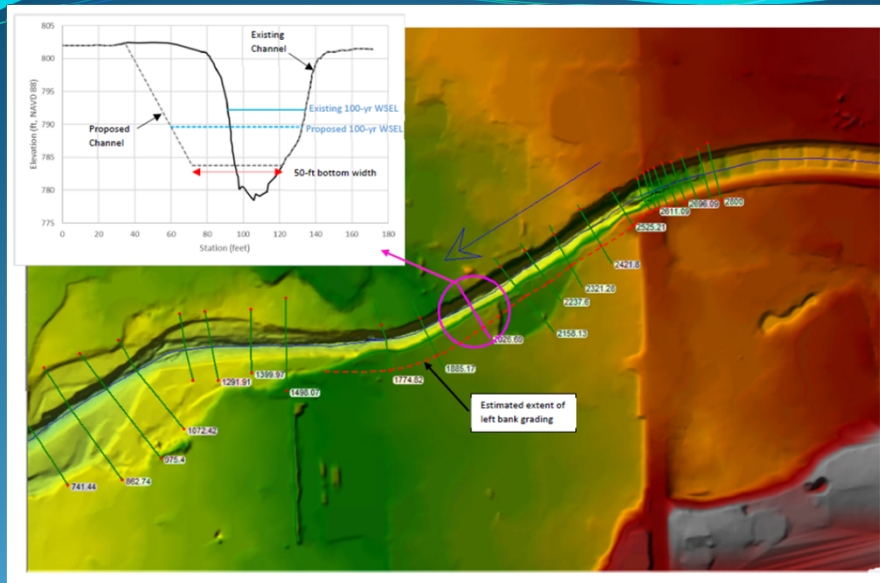


2/17/23



Channel Sections 12+00 to 15+00

Hydraulic Modeling – Option 2

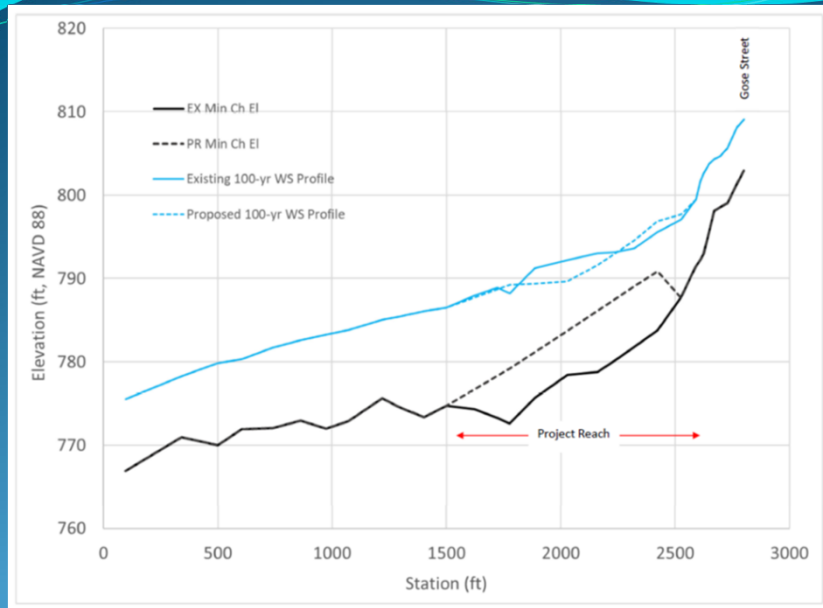


2/17/23



Location and Shape of Proposed Channel Widening

Hydraulic Modeling – Option 2

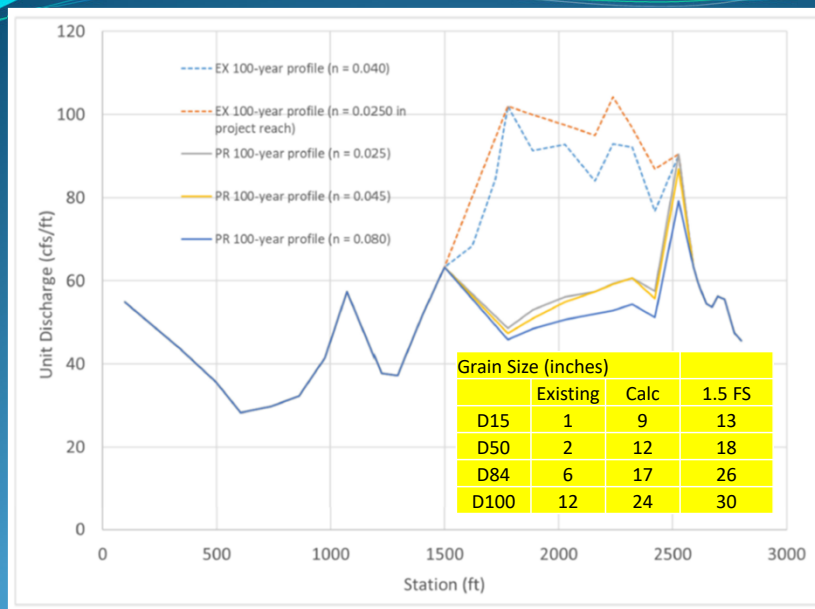


2/17/23



Change in 100 Year WS Profile

Hydraulic Modeling – Option 2



2/17/23



This graph shows for Option 2 ho raising and widening the channel lower the unit discharge

Existing Sediment Size

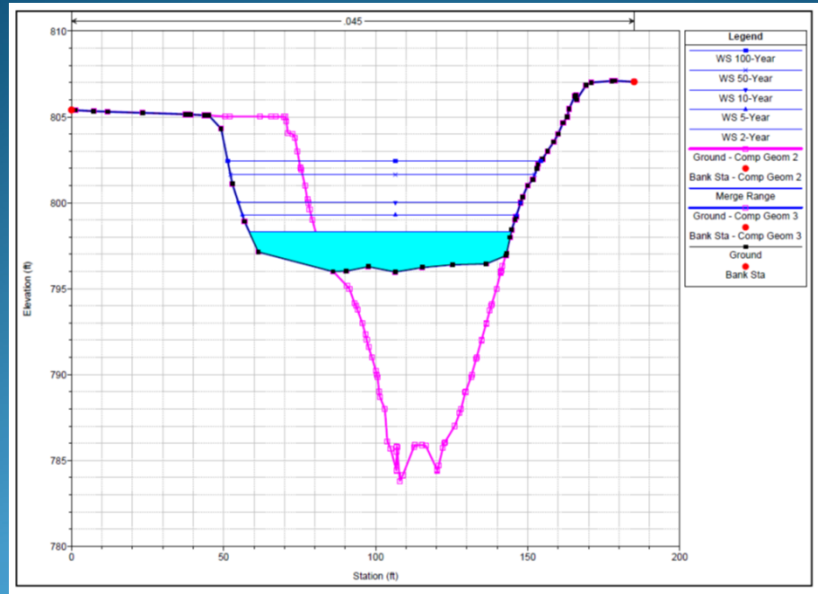


2/17/23



Photo from yesterday, sediment size, Freeze-thaw action is a common type of geomorphological processes eroding cliff faces

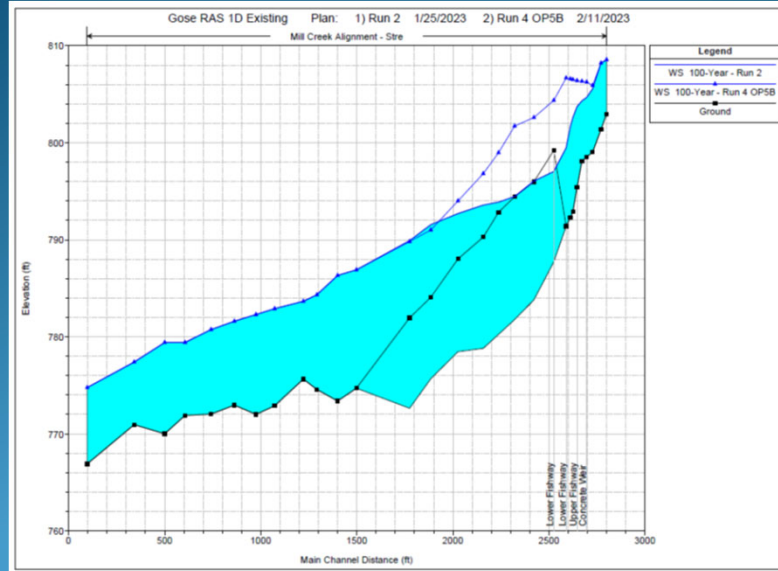
Hydraulic Modeling – Option 5B



2/17/23



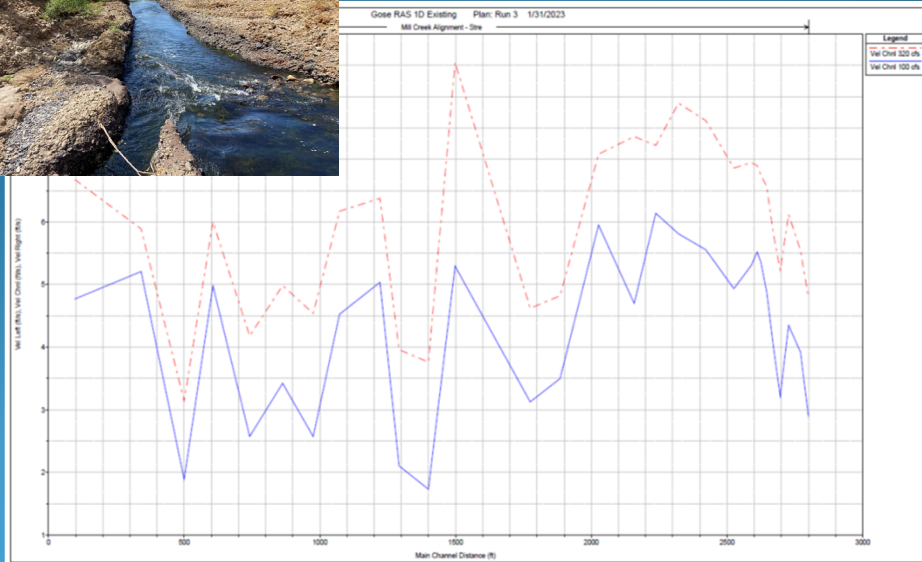
Hydraulic Modeling – Option 5B



2/17/23



Velocities in Channel Trench



Alternatives Analysis

Gose Conceptual Design Scoring											
Conceptual Options		Final Ranking Max = 310	Low Flow Fish Passage (5)	High Flow Fish Passage (5)	Risk to Infrastructure (1)	Channel Incision (1)	Mainten- ance (1)	R/W Issues (3)	Maintain Flood Control (1)	Constructability v (1)	Cost (2)
Rating Note: Each Design Option is rated from 1 to 10, 10 = fully addresses the attribute and, 1 = does not address the attribute.		Weighting Factor	5	5	2	4	4	3	3	3	2
Option 0	Option 0: Do Nothing	128	1	4	3	1	4	7	8	8	4
Option 1	Option 1: Nature-like Fishway (800' Long) with Pool and Chute Fishway - Backwater existing fishway with a new Pool and Chute Fishway and a 800 foot long, 1.4% slope Nature-like Fishway. Drops may have concrete or sheetpile cutoff walls to seal channel bed. Channel would be widened to 50 feet and banks sloped back.	177	6	6	6	4	6	5	7	5	7
Option 2	Option 2: Nature-like Fishway (1000' Long) - Backwater existing fishway with a 1000 foot long, 1.8% slope Nature-like Fishway. Drops may have concrete or sheet pile interior walls to seal channel bed. Channel would be widened to 50 feet and banks sloped back.	229	8	9	7	8	8	5	7	6	6
Option 3	Option 3: Pool and Weir Fishway with Dam - Construct a 12-step pool and weir fishway with a new dam across the channel. The fishway would be extended three to four feet below the bed.	191	5	7	7	7	5	5	7	7	6
Option 3B	Option 3B: Pool and Weir Fishway with Dam - Construct a 23-step pool and weir fishway with a new dam across the channel. The downstream end of the fishway would be extended three to four feet below the bed and the upstream section would be into the end of the flood control channel. Both existing fishways would be abandoned.	203	6	8	7	7	6	5	7	7	5
Option 4	Option 4: Bypass Channel: Excavate a 1670 foot long channel, 20 to 30 feet wide at slopes from 4 to 0.5%. The upstream end would require flood control measures, gates, slots, a culvert under Gose, an overflow side channel to protect landowners from flooding, a fish barrier dam downstream.	208	8	8	5	5	6	4	8	8	7
Option 5	Option 5: Channel Weirs: This option would have 12 concrete or sheet pile weirs with one foot drops to raise the existing channel up to the existing fishway. Some channel widening would be required, but not as much as Options 1 and 2.	190	4	6	6	5	7	8	7	7	7
Option 5B	Option 5B: Channel Weirs: This option would have 27 concrete or sheet pile weirs with one foot drops to raise the existing channel up to the invert elevation of the flood control channel. More channel widening would be required as compared to Options 1 and 2, and there would be a 5 to 6' flood rise.	241	10	10	4	7	9	7	5	7	6
Notes: (1) Option 0 Fish Passage: (0) - Underscored for amount of Flow; (1) - Fair Passage; Blocked at some flows; Excessive Turbidity (2) Excessive Fish Passage: (0) - Little Passage; (1) - Moderate Stranding or Injury (3) Risk to Infrastructure: (0) - Low Risk; (1) - High Risk (4) Channel Incision: (0) - No Incision to Bank Bed; (1) - 1' to 2' Erosion Below Existing Bank Barrier (5) Maintenance: (0) - No Regular Maintenance; (1) - High Risk (6) R/W Issues: (0) - No R/W Issues; (1) - Land parcels existing or for later removal and disturbance (7) Maintain Flood Control: (0) - No Impact on Conditions and Flow Risk; (1) - Minimal Flood Control Rating High Risk (8) Constructability: (0) - No Impact on Conditions and Flow Risk; (1) - Major Impact on Land Owners and High Risk (9) Cost: (0) - No Increase; (1) - High Cost											

Notes: (1) Upstream Fish Passage: (2) = Underscored from passage at all times, 1 = First Passage, Blocked at lower flows, Excessive Turbulence
 (3) Downstream Fish Passage: (2) = Safe Passage, 1 = Potential Drowning or Injury
 (4) Risk to Infrastructure: (2) = Low Risk, 1 = High Risk
 (5) Channel Incision: (2) = Subject to Future Bed Erosion, 1 = Future Bed Erosion May Create Barrier
 (6) Maintenance: (2) = Future easements, 1 = High Life Expectancy
 (7) Right of Way (ROW): (2) = No ROW issues, no utility, no permit problem, 1 = land purchase needed, pay for tree removal and disturbance
 (8) Maintain Flood Control: (2) = Performance Exceeds the Risk, 1 = Reduced Flood Control High Risk
 (9) Constructability: (2) = No impact on landowners and low Risk, 1 = Major impact on Land Owners and High Risk
 (10) Cost: (2) = Low cost, 1 = High cost

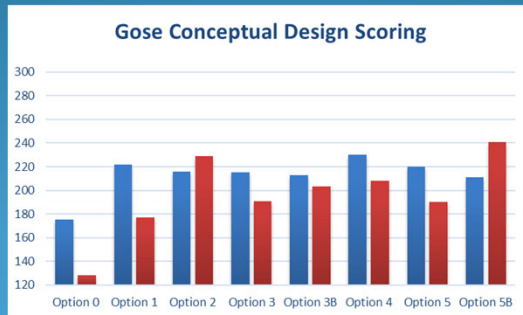


2/17/23

Jay to Discuss Alternatives Analysis Matrix.

Alternatives Analysis Scoring

	Attribute										
	Final Ranking	Low Flow Fish Passage	High Flow Fish Passage	Risk to Infrastructure	Channel Incision	Maintenance	ROW	Flood Control	Constructability	Cost	
		5	5	2	4	4	3	3	3	2	
Option 0	175	4	3	5	4	6	9	9	6	9	6.1
Option 1	222	7	7	7	6	8	7	8	7	8	7.2
Option 2	216	6	8	7	6	9	7	7	6	6	6.9
Option 3	215	7	6	8	7	7	8	7	7	6	7.0
Option 3B	213	7	6	8	7	7	8	7	7	5	6.9
Option 4	230	9	8	6	8	6	5	8	8	7	7.2
Option 5	220	8	7	7	5	8	7	6	8	8	7.1
Option 5B	211	8	7	8	5	8	6	5	7	7	6.8

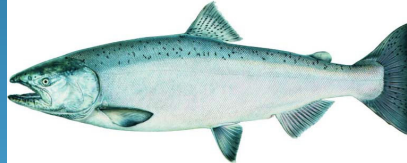


2/17/23



Example of how Jay and I scored design options. 310 max score. Included Option 0 Do Nothing.

Thank You!



2/17/23

